CENTER FOR BEAM PHYSICS SEMINAR

"A Recirculating Linac Based Synchrotron Light Source for Ultrafast X-ray Science"

John Corlett, CBP (LBNL)

Friday June 28, 2002, 10:30 AM
Albert Ghiorso Conference Room (71-264), LBNL
••• Refreshments served at 10:20 AM •••

Abstract: We describe the design of a proposed source of ultra-fast synchrotron radiation x-ray pulses based on a recirculating superconducting linac. The source produces x-ray pulses with duration of <100 fs at a 10 kHz repetition rate, optimized for the study of ultra-fast dynamics. A high-brightness RF photocathode provides electron bunches which are manipulated to provide a large x/y emittance ratio and small vertical emittance. An injector linac accelerates the beam to the 100 MeV range, and is followed by four passes through a 600 MeV recirculating linac. Short x-ray pulses are obtained by a combination of electron pulse compression, transverse temporal correlation of the electrons, and x-ray pulse compression. We describe technical developments and requirements in key areas including high rep-rate rf photocathode design, flat-beam production, collective effects, lattice design, magnets, deflecting cavities, x-ray beamline optics, and synchronization between experimental pump lasers and the x-ray pulse.

Biographical information: After graduating in physics, John began work as an RF engineer at EEV in Lincoln, England, designing components and systems for radar applications. Seeing potentially interesting work in applying RF techniques to particle accelerators, he joined Daresbury Laboratory in the UK in 1986. There, in the SRS Accelerator Physics Group, he worked on RF cavity damping for the 500 MHz synchrotron radiation source cavities, as well as developing impedance measurements using coaxial wire techniques, collective effects studies on the SRS beam, pulsed kicker design, and accelerator physics studies for a VUV synchrotron radiation facility proposal. In 1991, he joined the fledgling Center for Beam Physics, working on impedance and collective effects and coupled bunch feedback systems for the ALS, followed by similar studies for the PEP-II B-factory. He has developed design concepts for muon cooling channel RF cavities, and led the LBNL NLC effort in damping rings design studies. He leads the Beam Electrodynamics Group in the Center for Beam Physics, and is currently P.I. for the Femtosource project, a feasibility study for an ultra-fast x-ray source for femtosecond dynamics.